

INCIDENCE OF ACARID MITES ON THE BIOLOGY OF BEES.

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(Plate 1, text figure 1.)

Mites are small animals, generally white or amber-coloured, or even pinkish, with a more or less oval body comprised of two parts, the conjoined head and thorax, propodosoma, the abdominal segment, hysterosoma, and in certain species a gnathosoma, carrying the mandibulae and eyes; they have four pairs of legs, sometimes with spines, and often with long setae.

Mites are ubiquitous, being distributed throughout the world, and associated with all classes of animals, including man himself. Their general aspect under magnification is rather repellent, especially those species armed with powerful claws. If the acarids grew to even one foot in diameter they would indeed be formidable enemies. Fortunately they are all minute in size, but nevertheless capable of laying eggs, producing a tormenting irritation, and even poisoning of the host. There is, of course, no larval stage, and the young ones more or less resemble the adults.

Taxonomically, they are included in the Phylum ARTHROPODA, or jointed leg animals, arthron—a joint, and podos—foot, and belong to the Sub-class ARACHNIDA, Gr. akares—too small to cut, tiny things. The spiders are included here. The Family is ACARIDIDAE, and there are numerous genera.

Though small, the mites are nevertheless important, not only because of their ubiquity, but also for their acute incidence on so many of man's activities. They attack his crops, farinaceous meals and flours; domestic pets; find a way into the quills of caged birds; pester man, and even burrow into his own skin. None escapes the attentions of the mites, not even the bees, and solitary and social species are infested with equal favour.

The microscopic size of many species is a protection in itself, for they are too small to be seen by the unaided eye; they are bothersome to mount and study, and several are difficult to remove from the host.

The late Edwin Step suggested that the male bee, having no work to do, did not accumulate on its body any of the debris that afford sustenance to the mites, therefore the male did not suffer any infestation. That is mere specious speculation, for critical examination of a series of wild-bees will soon demonstrate that males are quite often as heavily infested as the females. Step may have postulated that as many species of mites are found on meals and flours, the male bees escaped because they did not carry on their bodies any of the nitrogenous pollen-grains enmeshed in the fleece of the female bee. He failed to appreciate the fact that the males of all wild-bees normally visit flowers for a sip of nectar, and cannot escape being dusted with pollen.

Microscopic study of live mites on a wild-bee that had large areas of its body growing a mould producing a purplish-black sporangium, showed that many of the acarids had ingested a few of the sporangia. The author is unable to determine whether or not spores form portion of the normal diet of mites, but he is certain that moulds and yeasts are entirely absent in bees' cells frequented by the acarids, but such microscopic growths are inevitable in cells studied in the artificial conditions of the laboratory. If the association of bees and mites be thus mutually beneficial, then the tiny animals are undoubtedly symbiotes and not parasites.

After a study of the mite *Parasitus bomborum* in the "nests" of the European bumble bees *Bombus (Bremus)*, Plath (1934) concluded that the association of mite and bee was mutually beneficial. The absence of mites in cells and shafts may be the determining factor in the many failures in laboratory experiments to rear fossorial bees to maturity.

However, the author has observed acarine mites piercing the delicate pellicle of bees which had died during the fourth ecdysis, but whether or not the entrance

had been effected by biting or dissolving the membrane could not be determined. He has seen a mite enter a bee's cell, exude a droplet of clear liquid on the colloidal lining, and then ingest it again. The liquid may have dissolved some of the biological substance.

Recently, Armour and Campbell (1948) have found in parrots (budgerigars) suffering from "French Moulting" that certain tyroglyphid mites were present in the base of the quills, causing a black substance to accumulate in the shaft. This is, of course, analogous to the mites' penetration of the tracheal tubes of the honey-bee.

The late Professor T. D. A. Cockerell concluded that since the Australian carpenter bee had no cavity in the base of the abdomen, it did not harbour a mite like the *Paragreenia* of the Indian *Koptorthosoma*. An extended study by the author of the carpenter bee *Xylocopa* demonstrated that the Australian species certainly has numbers of other mites on its body. My mentor always regretted that he had not been able to study the bees on their native heath.

The short list of bees and mites included in this paper may serve to dispel certain popular misconceptions. It will be observed that many diverse genera are recorded, so that it is probable that all bees are infested at one time or another. Rennie and his assistants postulated that normally the mites lived on the exterior of the wild-bee, but discovered by some chance that they would enter the spiracles of the honey-bee and breed there.

I am indebted to the courtesy of Mr. W. Womersley, Adelaide Museum, South Australia, for the generic names of the mites. Several of the specimens were new to science, and the generic and specific affinities of these are being worked out by Mr. Womersley for publication.

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Family: COLLETIDAE.

HOST: *Heterocolletes capillatus* Rayment.

Medium-sized black shining bees with much dull white hair. The compound eyes have numerous long hairs issuing from between the facets.

Biology: Similar to that of *Paracolletes*. (See "A Cluster of Bees," 1935.)

Symbiote: The specimens were too fragmentary for determination.

Comment: Two amber-coloured mites were taken from the axillae of the wings.

Locality: Emerald, Dandenong Ranges, Victoria.

Collector: T. Rayment.

HOST: *Euryglossomorpha nigra* Sm.

Shining black bees of medium size, often coarsely punctured, with scattered hair.

Biology: A fossorial species, digging a shallow shaft with an elbow turn. The oval skin cells hold a batter pudding of honey and pollen. (See author's account, "Australian Zoologist," xi, 3, 1948, p. 243.)

Symbiote: Adults of Tyroglyphid mites.

Comment: These bees often carry a number of mites distributed over the body. A large percentage of the bees harboured a parasitic *Stylops*.

Locality: Mount Canoblas, Orange, N.S.W. (Alt. 4,600 ft.)

Collector: P. Whiteley

HOST: *Paracolletes advena phillipensis* Raym.

Black bees of medium size, with four narrow bands of white hair across the abdomen. *P. euphenax* Ckll. is the male of the species.

Biology: They excavate deep shafts in sandy soil, and construct several cells of impalpable silvery skin, and the "pudding" is a rather thin batter of honey and pollen. There is only one brood for the season, and it emerges in spring.

Symbiote: Probably a new species of *Tyroglyphus*.

Comment: Numbers of minute white mites were present at the hairy junction of the thorax and the abdomen.

Locality: Gorae West, Victoria, 26 Sept., 1952.

Collector: Clifford W. Beaglehole.

HOST: *Neopasiphae insignis* Raym.

A small black bee, with transverse yellow bars on the abdomen. The male has excessively large circular scapes.

Biology: Not known, but the morphology would indicate a fossorial habit akin to that of *Paracolletes*.

Symbiote: Apparently a new species of *Histiostoma*.

Comment: This mite was found among the plumose hairs of the body in the vicinity of the metathorax.

Locality: Victoria? (No. of Best's label "570.")

Collector: D. Best.

Family: HYLAEIDAE.

HOST: *Hylaeus annelanocephalus* Raym.

Small bees with a black head and thorax and a red abdomen.

Biology: (See author's account, "A Cluster of Bees," 1935.)

Symbiote: Hypopus stage of *Anoetus* sp.

Comment: A dozen or more mites were taken from the basal abdominal terga, where they were in a compact mass.

Locality: Lane Cove, Sydney, N.S.W.

Collector: Norman W. Rodd.

HOST: *Hylaeus annelanocephalus* Raym.

Biology: Cells of thin skin are built in galleries in wood.

Symbiote: *Anoetus* sp.

Comment: One mite was on the metathorax.

Locality: Cheltenham, New South Wales,

Collector: Norman W. Rodd,

HOST: *Hylaeus cliffordiellus* Raym,

Small jet-black shining bees with yellow markings.

Biology: They build a series of skin cells in cavities in wood-stems and other suitable places. (See notes on biology in "Bees of the Portland District.")

Symbiote: *Calvolia* sp.

Comment: About 25 very small mites were removed from the ventral surface of the male's abdomen.

Locality: Gorae West, Victoria, Jan., 1952.

Collector: Clifford W. Beauglehole.

HOST: *Hylaeus elongatus* Sm.

A small blackish bee, with yellow face-markings, and little or no hair.

Biology: Although the author has not studied the life-history of this particular species, there is little doubt that it follows the typical pattern—colloidal skin cells in any suitable cavity. (See *Euryglossina*.)

Symbiote: *Calvolia* sp.

Comment: The mites, about ten in number, were clustered together in the polished basal abdominal sternum. The bees could easily have reached them with their legs.

Locality: Swan River, Western Australia.

Collector: L. J. Newman.

HOST: *Hylaeus honestus subhonestus* Ckll.

Black shining bees with little if any hair, and a few yellow markings.

Biology: Not known, but other species of *Hylaeus* construct cells of thin skin.

Symbiote: Not determined.

Comment: Twenty-five mites were taken from the mesothorax.

Locality: Gorae West, Victoria, 10th Dec., 1951.

Collector: Clifford W. Beauglehole.

HOST: *Hylaeus maiellus* Raym.

Small, roughly sculptured black bees with a ferruginous abdomen.

Complete life-history not known, but the colloidal thin skin cells do not differ from the typical pattern of the family. (See *Palaeorhiza*.)

Symbiote: *Tyroglyphus* species, differing from *T. farinae* (Linnaeus) by the striate, not punctured, hysterosoma.

Comment: Eight amber-coloured mites were taken from the sternal surface of the thorax of the males.

Locality: Boorooloola, Northern Australia; Edungalba, Queensland; Gunbower, Victoria.

Collectors: Gerald F. Hill, Ernest E. Adams, Tarlton Rayment.

HOST *Hylaeus nigrojugatus* Raym.

Very small black bees.

Biology: A series of tiny thin skin cells built in beetle-galleries in the pine boards of a door.

Symbiote: Not determined.

Comment: In certain cells about 18 small pear-shaped white egg-like forms were found. These were gradually developing mites that appeared to be approaching *Anoetus* sp.

Locality Clyde, South Gippsland, Victoria.

Collector: O. Dawson.

HOST: *Palaeorhiza alcyonea* (Erich.).

A handsome large bee, with a black head and thorax and a metallic-blue abdomen. The "face" is ornamented with three yellow stripes, and the collar, tubercles, and scutella are butter-yellow. The subsp. *robustus* Ckll. is larger, with two large spines on the third sternum of the male. The bees have been observed on the flowers of *Banksia* sp., *Lambertia* sp., and *Callistemon* sp.

The "nest" is typical of the Family, but as this is the first published record, the description is given in some detail. The cells were built in a twig from a dead *Acacia*—Froggatt, in litt., says *A. longifolia*. The wood is hard, and the entire tube measured 6cm. in length. There were four cells, each measuring 12 mm. in length, with a diameter of 5 mm., and separated from each other by a thin clear colloidal membrane which had been "licked on" by the glossa.

The base was filled with a mass of loose wood-parings, and covering that was a stouter plug, possibly containing some resinous material. The pudding was placed on this solid base, and the egg was attached to the pudding. The wood had been scooped out roughly, but the wall was heavily draped. The pudding was of a dry mealy consistency, and the pollen-grains resembled miniature golden rice.

Symbiote: *Tyroglyphus* sp.

Comment: A number of mites were on the bee, but 90 parasitic small chalcid wasps emerged from one larva.

Locality: Cheltenham, N.S.W., 19th November, 1950.

Collector: Norman W. Rodd.

This bee is widely spread, for the author has received it from Tasmania, New South Wales, Western Australia, South Australia, and Victoria

HOST: *Euryglossina hypochroma* Ckll.

A minute black bee, with yellow markings; abdominal sterna yellow.

Biology: The small bees occupy galleries bored by the pin-hole and other beetles in wood. They construct a series of colloidal skin cells. (See author's account in the magazine "Walkabout.")

Symbiote: A male mite *Tyroglyphus farinae*.

Comment: Very rarely are mites found on these bees; only an odd one is present on the base of the abdomen.

Locality Sandringham, Toorak, Tooradin, Victoria.

Collectors: Owen Dawson and Tarlton Rayment.

HOST: *Meroglossa basilauta* Raym.

Large black shining bees, with very little hair, and primrose markings on face and thorax. Glossa short and emarginate in female, acute in male.

Biology: The bees bore clean-cut galleries in sound, hard wood, and fill their oval cells of colloidal membrane with a soft batter of honey and pollen.

Symbiote: Hypopus stage of *Anoetus* sp.

Comment: About five large amber-coloured mites were present on each side in the cavity on the scutellum at the base of the wings.

Locality: Jamberoo (Alt. 2,100 ft.), Illawarra Range, N.S.W.

Collector: Norman W. Rodd.

HOST: *Meroglossa basilauta* Raym.

Four deutonymphs were taken from cavities at the sides of the scutellum of the female.

Locality: Gorae West, Victoria, 23rd Dec., also 16th Jan., 1951.

Collector: Clifford W. Beauglehole.

Family HALICTIDAE.

HOST: *Parasphecodes altichus* Smith.

Bees of medium size with black head and thorax, and only the first and second segments of the abdomen with any reddish colour.

Biology: [See *P. fulviventris* (Fr.) for details of the biology.]

Symbiote: A new genus and species of Laelaptidae (Nymphs).

Comment: Two large amber-coloured mites were attached to the thorax near the axillae of the posterior wings of the male.

Locality: Jamberoo, N.S.W.

Collector: Norman W. Rodd.

HOST: *Parasphecodes fulviventris* (Fr.).

Bees of medium size, with a dull-black head and thorax and red abdomen.

Biology: A fossorial species excavating its chambers and shafts in the earth, and huge colonies are sometimes formed. (The author described the biology in "Australian Zoologist," Vol. xi, Pt. 2, pp. 76-95, 1947.)

Symbiote: *Caloglyphus berlesii* (Michael).

Comment: These mites are the scavengers, keeping shafts and cells free from all biological debris. They seldom if ever attach themselves to the bees.

Locality: Sandringham, Victoria.

Collector: Tarlton Rayment.

HOST: *Parasphecodes sextus* Ckll.

Bees of medium size, with black head and thorax and red abdomen (species in this genus are difficult to determine).

Biology: (See author's account of *P. fulviventris*, "Australian Zoologist," Vol. II, Pt. 2, pp. 76-95, 1947.)

Symbiote: *Caloglyphus berlesii* (Michael).

Comment: These were numerous on larvae of the bee, and measured 75 microns in length.

Locality: Rocklands, Victoria.

Collector: Owen Dawson.

HOST: *Parasphecodes cirriferus* Ckll.

A bee of medium size with black head and thorax and a red abdomen; wings are dusky.

Biology: [Refer to *P. fulviventris* (Fr.), for details.]

Symbiote: (See *P. tilachiformis*.)

Comment. Professor T. D. A. Cockerell (Trans. Amer. Ent. Soc., XXXVI, 1910), describing the above species, made the following note: "Two large rufous mites are attached to the metathorax." It is possible that the mites in this case are of the same species as those taken from *P. tilachiformis*. In February, 1951, the author received a series of quite typical females, and males (including the allotype) of *P. cirriferus*, from Gorae West, Victoria. Two of the females had two large mites adhering to the metathorax, but one female had five clustered closely over the dorsum of the metathorax. Another female had one mite on the dorsum, and another under the axilla of a wing. One male bee had one mite on the dorsum, but the usual number is two to the bee. These very large mites were separated by Womersley as a new genus and species of the Family Laelaptidae, and he proposes to publish the generic diagnosis and specific description.

Locality: Victoria. Gorae West, via Portland, Victoria.

Collectors: Chas. French, Junr.; Cliff. Beauglehole.

HOST: *Parasphecodes fultoni* Ckll.

A wild bee of medium size, with a black head and thorax and a dark-red abdomen.

Biology: These fossorial bees excavate shallow burrows leading to oval cells six or so inches below ground level, (Refer to *P. fulviventris*.)

Symbiote: *Hypoaspis* sp.

Comment: Many mites were present in the earthen cells, and a few, six or so, were taken from each of the several female bees examined by the author. It would appear that in *Parasphecodes*, as in *Halictus*, the earthen nests are maintained in a sanitary condition by the numerous acarid mites which are, therefore, true symbiotes, and not parasites, as in the case of *Tarsonemus woodi* on the honey-bee.

A female *Parasphecodes fultoni* Ckll. was taken on the South Coast, 252 miles west of Dandenong, in a very different environment, and eleven mites were present.

The mites appear to be *Hypoaspis* sp., conspecific with those taken from the nests at Dandenong.

Locality: Gorae West, Victoria, 28th April, 1952.

Collector: Clifford W. Beauglehole.

HOST: *Parasphecodes tilachiformis* Ckll.

A red and black male bee of medium size, closely related to *Halictus*.

Biology: [Refer to *P. fulviventris* (Fr.) for details of the biology.]

Symbiote: A new genus and species of Laelaptidae.

Comment: Two large amber-coloured mites were attached to the sternal plates of the thorax.

Locality: Jamberoo, N.S.W.

Collector: Norman W. Rodd.

HOST: *Halictus darlingensis* Raym.

Biology: Females of a midsummer brood; no males were among them. (See author's large paper on Halictine bees.)

Symbiote: *Histosoma* sp.

Comment: One mite was taken from the under surface of the wing of an adult female.

Locality: Tilpa, Darling River, N.S.W.

Collector: Courtesy of Dept. Agric., New South Wales.

HOST: *Halictus emeraldensis* Raym.

Small black fossorial bees with abdominal bands of white hair.

Biology: Several hundreds congregate to form a co-operative colony in the earth. There are three discrete generations—a spring brood of virgins, a midsummer bisexual one, and an autumn brood of virgins. (See author's account "Arb phys ange," Ent. Berlin-Dahlem, Band 4, Germany, 1937.)

Symbiote: *Caloglyphus* sp.

Comment: Numerous white mites literally cover the walls of the galleries and cells, and keep them in a sanitary condition. They are not distributed by the bees, but by parasitic mutillid wasps, which visit many galleries. At certain periods there is a remarkable segregation of the sexes; all the mites in one gallery will be males and in another all females. When the mites were removed from contact with the halictine cells they succumbed within twenty-four hours, probably from starvation.

Locality: Emerald (alt. 1,100 ft.), Victoria.

Collector: Tarlton Rayment.

HOST: *Halictus erythrurus dimorphus* Raym. (MS.)

Small but remarkable chloralictine bees, the spring females having an apricot abdomen.

Biology: The midsummer brood is a bisexual one of jet-black females and males; the autumn brood is composed of black virgins. The spring virgins have a dark-green mesothorax. (The author has a comprehensive paper on this species in MS.)

Symbiote: Probably *Caloglyphus*.

Comment: These frequent the cells, and are of a creamy colour, but are seldom present on the bees, and appear to maintain the nests in a sanitary condition. No biological debris can be found in the bees' cells when mites are present.

Locality: Dandenong, Victoria.

Collectors: Owen Dawson and Tarlton Rayment.

HOST: *Halictus gilesi* Ckll.

Small black bees with some rather sparse white hair.

Biology: Gregarious bees digging shafts in the ground.

Symbiote: *Histosoma* sp.

Comment: 25 mites were clustered about the metathorax.

Locality: Gorae West, Victoria, 7th Dec., 1951.

Collector: Clifford W. Beauglehole.

HOST: *Halictus littleri* Ckll.

Small black bees with a dusting of white hair.

Biology: They excavate a large number of cells, forming a colony in the ground, the sisters working together in partial co-operation.

Symbiote: *Histosoma* sp.

Comment: About 25 large golden mites were taken from a female bee.

Locality: Gorae West, Victoria, Nov., 1951, also Jan., 1952.

Collector: Clifford W. Beaglehole.

HOST: *Halictus leai* Ckll.

Small black bees with red legs; the golden transverse bands on the abdomen are due partly to tegument and partly to golden hair.

Biology: The oval cells were excavated in firm, closely-textured black peat. The species is gregarious, but not so strongly as other halictine bees. (A full account of the biology of this bee is in MS.)

Symbiote: (Appear to be the same species as in *H. emeraldensis* Raym.)

Comment: Large numbers of mites were studied in the cells and on the bees. One dead female yielded 25 eggs, and 16 live mites, which were congregated under the head, and about the soft chitin near the articulation of the coxae. The large broad-oval eggs were distributed over the body, and measured 105 microns at the long axis and 65 microns at the short, and were covered with microscopic raised bosses arranged in rows.

The youngest mites show no conspicuous change when they hatch, the chorion of the egg appears to develop a few hairs, so that it is difficult to determine just when the young has hatched; the two anterior pairs of legs are the first evidence.

The bloated white mite appears to have great difficulty in climbing or crawling over the hairy body of the bee, pulling itself along by grasping the hairs with the two anterior pairs of legs, which are much stronger; the third pair meanwhile maintaining a rowing motion; the hind pair appear to have but little function in locomotion.

The cast white skins of the mites were numerous over the body of the bee.

In halictine species investigated by the author large numbers of mites were present in the cells, and since these are always deep in the earth, it is almost certain that the mites are symbiote, and not parasitic, for the cells are immaculate.

Locality: Cranbourne, Victoria.

Collector: Owen Dawson.

HOST: *Halictus bremerensis* Raym.

A small green and apricot-coloured chloralictine bee from Western Australia.

Biology: See author's accounts in "A Cluster of Bees."

Symbiote: *Calvolia* sp.

Comment: Two or three mites were present on the base of the abdomen.

Locality: Western Australia.

Collector: Tom Greaves.

HOST: Larvae and pupae of *Halictus peraustralis* Ckll.

Bees of medium size, with spots and bands of golden hair.

Biology: There are three discrete generations as in *H. emeraldensis* Raym., but the colony of *H. peraustralis* is established in the trunk of a tree well above ground; a unique departure from the typical habit. (The author has a large paper on the Biology of this *Halictus* in MS.)

Symbiote: Uropodid mites, probably new sp. of *Phaulodimychus*.

Comment: When taken from the larvae and the pupae of the autumn generation, Tertianus virgins, the mites were pinkish to reddish in colour. None of these mites were present on the Secundarius (midsummer) generation, or the spring Primarius virgins.

Locality: Cheltenham, N.S.W.

Collector: Norman W. Rodd.

HOST: *Halictus victoriellus* Ckll.

Small black bees with faint bands of white hair, very close to *H. emeraldensis* Raym.

Biology: This fossorial species favours loose sand for its colonies. (See author's account, "A Cluster of Bees," 1935.)

Symbiote: *Calvolia* sp.

Comment: A cluster of eight or so mites in a geometrical pattern in a "pocket" at the base of the abdomen.

Locality: Sandringham, Victoria.

Collector: Tarlton Rayment.

Family: MEGACHILIDAE.

HOST: *Megachile abdominalis* Sm.

A bee of medium size with large black head, black thorax, and abdomen of apricot-red.

Biology: Although in the Leaf-cutters' Family, Megachilidae, yet they do not cut leaves, but construct cells of resinous wax in any suitable cavity, generally in wood. The species is a northern one.

Symbiote: *Sennertia bifilis* Canestr.

Comment: The mites, about eight in number, were assembled at the base of the abdomen, in a cavity.

Locality: Brisbane, Queensland, but they are widely distributed over the Northern State.

Collector: H. Hacker.

HOST: *Megachile chrysopga* Sm.

Large black bees, with red hair on face and tip of abdomen; otherwise there is much long white hair.

Biology: The bees build a series of leafy cells in any suitable cavity, usually in wood.

Symbiote: *Sennertia bifilis* Canestr.

Comment: Four mites were taken from the metathorax.

Locality: Bolgart, Western Australia, 11th March, 1948.

Collector: Rica Erickson. The author also bred out specimens of this bee from leafy cells sent to him by Clifford Beaglehole. (See "Bees of the Portland District," May, 1953, Portland Field Naturalists' Club.)

HOST: *Megachile deanii* Raym.

A small black bee with a red abdomen. One of the "leafcutters" that makes a "nest" of waxen cells. (See author's "Cluster of Bees," p. 450, 1935, for a full account.

Biology:

Symbiote: *Sennertia queenslandica* Womers.

Comment: Six large white mites were in two groups of three on the metathorax of a female bee which had only just emerged from a waxen cell.

Locality: Denman, N.S.W., 15th May, 1951.

Collector: R. E. Martin.

HOST: *Megachile*, perhaps a variety of *M. lachesis* Sm.

A large black leaf-cutter male bee which differs from *M. lachesis* by the black and white hair of face; *lachesis* has red hair.

Biology: No details are available.

Symbiote: A species of TROGLYPHOIDEA, apparently close to that present on *M. lachesis* Sm.

Comment: About 50 or so mites were scattered over the body, chiefly about the metathorax.

Locality: Bulolo, New Guinea.

Collector: B. Hough (per Agric. Dept., New South Wales).

HOST: *Megachile erythropyga* Smith.

A small black male, with red hair on face and tip of abdomen, the base of which has white hair.

Symbiote: (*Deutonymph*) *Sennertia bifilis* Canestr.

Comment: Ten large mites found near axilla of wing.

Locality: Bayswater, Victoria, 3rd February, 1916.

Collector: Probably the late F. Spry.

HOST: *Megachile lachesis* Sm.

A very large black leaf-cutting species, with a few reddish hairs on the "face" of the male, and fuliginus wings.

Biology: Builds usually in sandy banks, often near the sea. The life-history of this handsome bee was published by the author in the March issue of "Wild Life" magazine, 1949. The leafy cells are constructed at the end of horizontal galleries, and are ravaged by a parasitic bee, *Coelioxys intrudens* Sm.

Symbiote: A new species in the Family TYROGLYPHOIDEA.

Comment: The pale-amber mites, about 30 in number, were present on the abdominal sterna of both sexes, but numbers of dry skins were scattered over the

body in both males and females, and one or two live mites were present. The minute white animals have difficulty in crawling over the fleece of the bee, and pull strongly with the anterior four legs; the third pair having a weak "rowing" action; the posterior pair appear to be of little use in walking. The striae are longitudinal on hysterosoma and transverse on propodosoma.

Locality: Wewak, New Guinea.

Collector: Lt.-Col. Hoare, A.I.F., and M. Faddy, Esq.

HOST: *Megachile semiluctuosa* Sm.

Biology: The cells are not built of leaves, but modelled of resin, and perhaps kino, in clean, hard timber, and it appears that the bees may have bored the chambers.

Symbiote: Deutonymphs of *Sennertia bifilis* Canestr.

Comment: About thirty of these mites were congregated about the metathorax of a female bee. These appear to be the same species that infest the Carpenter of the Grass-trees, *Lestis bombylans* Fabr.

Locality: Swan River, W.A. The specimen is very old.

Collector: L. J. Newman.

HOST: *Megachile quinquelineata* Ckll.

A medium-sized black bee, with five narrow bands of white hair across the abdomen.

Biology: Typical leaf-cutters construct cells of leafy pieces, but a large group use resin and wax. It is not yet known to which group this bee belongs.

Symbiote: A new species of *Calvolia*? (Deutonymph).

Comment: About 15 golden mites were scattered over the head and thorax.

Locality: Brisbane, Queensland.

Collector: Cedric Deane.

HOST: *Megachile trichognatha tosticauda* Ckll.

Medium-sized black bees with much white hair.

Biology: The bees occupy tunnels bored by longicorn beetles in dry timber, and build therein a series of chambers constructed of resin, kino and wax. (The nest was described by the author in "Walkabout" magazine.)

Symbiote: Not yet determined.

Comment: Seven mites were taken from the long fleece.

Locality: Moama, New South Wales, 10th March, 1937.

Collector: Rayment. The bees were bred out of cells.

HOST: *Megachile revicta* Ckll.

Biology: Large black bees, with much white hair about the base of the abdomen. They have the usual large head of the Family.

Symbiote: Not yet determined.

Comment: The mites, twelve or so, were taken from both males and females, and were clustered about a depression on the base of the abdomen, which is, perhaps, the most protected portion of the bee's body and the shelter most favoured by the Acarids.

Locality: Sawyers Valley, W.A.

Collector: L. J. Newman.

HOST: *Lithurgus rubricatus* Sm.

A black, shining bee of medium size.

Biology: Reputed to be parasitic on *Megachile*, but the sole "nest" investigated by the author contained several thin-walled cells of mud. They are widely distributed over the northern parts of Australia.

Symbiote: A new species of *Sennertia*.

Comment: The mites, about eight in number, were congregated about the base of the abdomen of a female.

Locality: Moora, W.A.

Collector: L. J. Newman.

Sub-family: COELIOXYNAE.

HOST: *Coelioxys albolineata* Ckll.

Black bees, with pointed abdomen, some with a few white bands of hair.

Biology: Parasitic in the cells of leaf-cutting bees, *Megachile*. (See author's account in "A Cluster of Bees," 1935; also in "Wild Life," July, 1949.)

Symbiote: Probably new Genus and Species of PONTOPPIDANIIDAE.

Comment: About 15 mites in circular depression at base of abdomen. The parasites choose this sheltered cavity because the host has less chance of reaching them there by brushing or combing with the legs. All bees use the legs continuously for cleansing the fleece.

Locality: Cairns, Queensland.

Collector: J. Mansky.

HOST: *Coelioxys froggatti* Ckll.

Black bees with dots of white hair, and apex of abdomen contracted to a fine "tail."

Biology: All are parasitic in the cells of the Leaf-cutting bees, Megachile. (See author's account in "A Cluster of Bees," 1935.)

Symbiote: *Tyroglyphus* sp. (deutonymphs), not *farinae* (L.).

Comment: Large numbers, 30 or more, of amber-coloured mites were clustered over the legs, coxae and femur of a male bee. Almost all of the Gunbower species had mites, but bees from Ororoo had none.

Locality: Gunbower, Victoria.

Collector: Tarlton Rayment.

HOST: *Coelioxys froggatti* Ckll.

Comment: A dozen or so mites were congregated about the median coxae of the bees.

Locality: Swan River, Western Australia.

Collector: L. J. Newman.

Family: ANTHOPHORIDAE.

HOST: *Asaropoda bombiformis* (Sm.).

Large foxy-red hairy bees which construct large mud cells in tunnels in the ground.

Symbiote: *Calvolia* sp.?

Comment: Numbers of pale-amber coloured mites are sometimes present on the copious fleece of these bees. (See author's "Cluster of Bees," 1937, for description of cells and biology.)

Locality: Sydney, N.S.W.

Collector: Phillip Whiteley

Family: XYLOCOPIDAE.

HOST: *Lestis bombylans* Fabr.

A handsome peacock-blue and green bee, not quite so large as the true carpenter-bee.

Biology: Builds a series of cells in the dry flower-stalks of Grass-trees, *Xanthorrhoea* sp. The mother "broods" over her progeny until it emerges, and this association forms a kind of primitive family. (The author described the biology in "A Cluster of Bees," 1935.)

Symbiote: Deutonymphs of *Sennertia bifilis* Canestr.

Comment: Many hundreds of mites were scattered promiscuously over the body of the bees and, if parasitic, could have caused an intolerable irritation. The deutonymphs—hypopial or wandering stage—are common on xylocopid bees, but adult mites have been found in the nests of Carpenter-bees.

Locality: Kuring-gai, New South Wales; Bowen, Queensland; New Guinea (on *Xylocopa combinata*); Moa Island, Torres Straits, Queensland.

Collector: Norman W. Rodd in New South Wales.

HOST: *Lestis aerata* var. *violascens* Ckll.

A beautiful polished species much bluer in colour than *L. bombylans*. The variety has a strong violet suffusion over the body, and the legs are slender.

Biology: Similar to that of *L. bombylans* Fabr.

Symbiote: Deutonymphs of *Sennertia bifilis* Canestr.

Comment: Several mites were taken from near the underneath of the axillae of the wings.

Locality: Wood's Reef, Barraba, New South Wales, 1942.

HOST: *Nomia australica reginae* Ckll.

A metallic-blue bee with bands of red on the abdomen and "face."

Biology: Gregarious bees digging shafts in the ground so closely that a large colony is formed.

Symbiote: Probably a new species of *Tyroglyphus*.

Comment: Six mites were taken from various parts of the body.

Locality: Meningie, South Australia.

Collector: Hans Minchin.

HOST: *Xylocopa (Mesotrichia) bryorum* (Fabr.).

The largest Australian bees; black, with a dense fleece of brassy-yellow hair over the thorax; the males are entirely covered by the yellow fleece.

Biology: The Carpenters bore galleries of large size in dry, hard timber, and make divisions of the sawdust to form their cells. The Japanese Carpenter-bee has a similar aspect.

Symbiote: *Sennertia queenslandica* Womers.

Comment: Two large mites were taken from the mesothoracic disc of a male bee, but numbers of smaller mites were present about coxae of the females. These were near to *Sennertia bifilis* (present also on *Lestis*) but differs by the transverse striae; it is partly concentric on hysterosoma in *S. bifilis*.

Locality: Cairns, North Queensland; Moa Island, Torres Straits.

Collectors: J. Manski; S. W. Schomberg.

Large specialised mites in the genus *Dinogamasus* are present in the "abdominal pocket" of certain xylocopids.

Family: CERATINIDAE.

HOST: *Exoneura concinnula* Ckll.

Small red and black bees, soft, shining and smooth.

Biology: The social bees of this genus usually build in plant-stems, but a series of "nests" were found in galls made by the beetle *Ethon affine* Cast. and Gory, on plants of *Pultenaea stipularis*. (See author's account of the biology of this social species, "Australian Zoologist," Vol. XI, Part 4, July, 1951.)

Commensal: A tyroglyphid, *Tyrofagus tenuiclavus* Zachvatkin.

Comment: The small white animal was clambering aimlessly over the cells in the gall. As it is related to the European flour mite, it was probably seeking pollen. Animals that feed at the same table are known as commensals.

Locality: Lindfield, N.S.W.

Collector: C. E. Chadwick.

HOST: *Exoneura dawsoni* Raym

Small, reed-dwelling social bees, usually with a black head and thorax and a red abdomen. A few species are entirely black.

Biology: (Refer to *E. montana* Raym., but many notes by the author on these bees have appeared in the "Victorian Naturalist," 1948-1949.)

Symbiote: *Anoetostoma* sp.

Comment: Taken from the pollen residues in the mesenteron of the larva. The mite had evidently been ingested with the pollen. It was interesting to discover a triungulin, another parasite of bees, in the debris.

Locality: Macedon, Victoria.

Collector: Owen Dawson.

HOST: *Exoneura montana* Raym. (Figure 1.)

Small reed-bees of social habit, with a black head and thorax and a red abdomen.

Biology: Primitive social bees, with several females co-operating in the rearing of the brood in plant-tubes. The larvae in this genus are unique in Australia in having "arms" and "fingers" on lateral appendages. There is sustained progressive feeding of the young. The author has described many of these bees in the "Victorian Naturalist," 1948-1949.

Symbiote: Deuteronymphs of a Tyroglyphid mite.

Comment: A female has about 20 mites on the membrane of each of the anterior wings. *Exoneuræ* are as a rule singularly free from mites.

Locality: White Swamp, New South Wales; Queensland border.

Collector: J. Hardcastle, Junr.

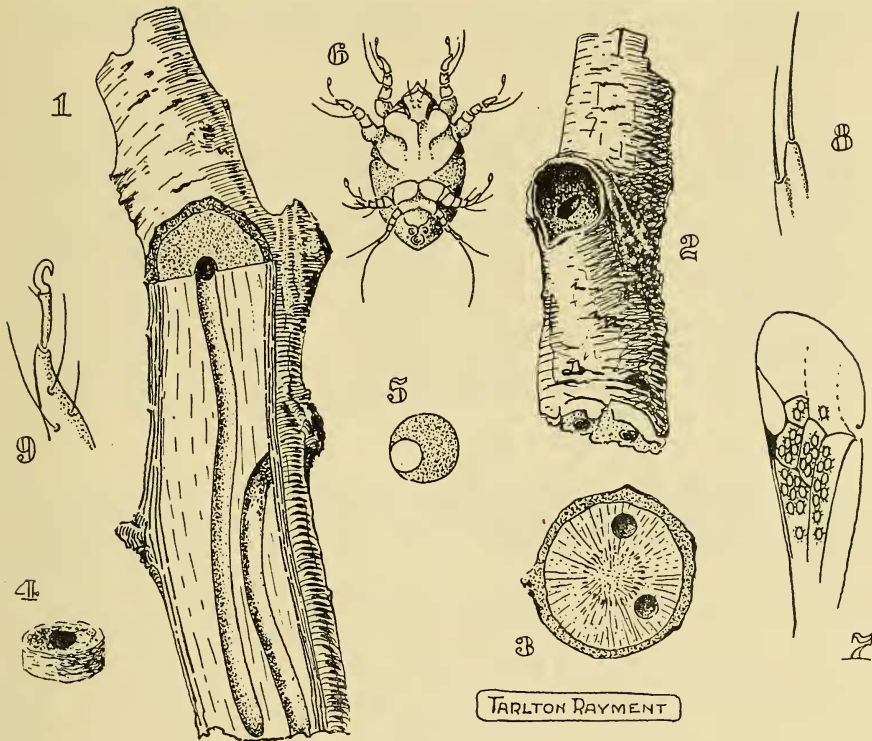


Fig. 1: The symbiote of *Exoneura montana*.

1. Section of punky cherry-wood, showing the bores of *Exoneura montana* Raym.
2. Exterior of the stick, showing the entrance in an old scar.
3. Cross-section; note the position of the bores.
4. A papery entrance plug, much enlarged.
5. The bee packs the powdery residue to one side.
6. The ventral surface of the tyroglyphid mite to display the eight legs; it is distinct from an insect, being nearer to a spider.
7. Large wing of bee with cluster of acarid mites adhering.
8. The two hind legs of the mite have no hooks.
9. The six others are powerfully armed to enable the animal to cling on to its host during flight.

Superfamily: APOIDEA.

Family: APIDAE.

Subfamily: APINAE.

HOST: *Apis mellifica* Linn., the hive or honey-bee.

Biology: The domesticated species form the highest group of the true social bees; they are organised in the most efficient commune known to man; they have a perfect distribution of labour; defending the hive by concerted attack; nursing the larvae; building several sheets or combs of hexagonal cells, in which are reared many thousands of workers, and a few hundred drones. The four or so queens

are cradled in typical oval cells of wax. The workers have ability to plot angles in the field, and to communicate them to the others when they return to the hive. *Apis* stands at the head of all insects.

Parasite: *Tarsonemus woodi*.

Comment: These small animals effected an entrance to the thoracic tracheae of the bees, thus interfering with the supply of oxygen, and poisoning the host with toxins. This mite exterminated the hive-bees in Great Britain during World War I, 1914-1919. The author has not succeeded in recording this species for Australia.

Locality: Great Britain.

Collector: Dr. J. Rennie and his assistants, 1921, were the original investigators of the condition.

HOST: *Apis mellifica* Linn.

Commensal: *Glycyphagus domesticus* (De Geer).

Comment: Found in the debris of bee-hives.

Locality: Perth, Western Australia, but widely spread.

Collector: Recorded by H. Womersley ("Studies in Australian Acarina," 1941).

HOST: *Apis mellifica* Linn.

Commensal: *Tyroglyphus farinae* (Linn).

Comment: Recorded as infesting the pollen of the bee-hive.

Locality: Adelaide, South Australia; Burnley, Victoria; but widely distributed in Europe. Recorded by H. Womersley.

EXPLANATION OF PLATE I.

1. A new genus and species of Tyroglyphid mite.
 2. A new species of Hypoaspis mite on bee, *Parasphcodes fultoni* Ckll.
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